High Use/Oil Control Decision Paper
Second Draft

Revised 12/6/95

Introduction and Background Information

This paper will provide background information on the relationship between type and intensity of land use and levels of oil and grease in urban runoff. This information was used in formulation of proposed high use thresholds for requiring oil and grease treatment of stormwater runoff.

Oil and grease are common constituents of urban stormwater runoff. The major source of these pollutants are leaks and drips from trucks and automobiles, industrial spills and leaks, and illegal dumping. The last of these sources is being addressed through the NPDES program and will not be discussed here. Structural spill controls are currently required both in the surface water design manual and in the BMP Manual. These requirements will not be affected by oil control requirements, although it may in some cases be possible to combine spill control and oil separation structures. The distinction is made here between large, sudden spills and small chronic leaks such as those from automobiles in parking lots.

Leaking trucks and automobiles contribute motor oil, transmission fluid, brake fluid, grease, and coolant fluid to urban runoff. These materials damage aquatic life by coating reactive surfaces (gills, leaves, etc.). In addition, they buildup in sediments, potentially causing toxic reactions in aquatic organisms (EPA, 1986). Thus they have the potential to significantly damage the aquatic environment. Although source control, in other words the control of leaks and spills from vehicles, would be the ideal solution to this problem, there are as yet few feasible alternatives for accomplishing this ideal. In lieu of source control then, we need to examine when and how oil and grease can effectively and economically be removed from stormwater runoff.

Petroleum tends to occur in highly localized "hot spots" in the urban environment (???, 1994). These are areas in which oil accumulation due to leakage from vehicles and fueling operations is large relative to the size of the property. Examples of hot spots include high turnover parking lots (fast food, convenience stores), gas stations, and high volume/long-delay road intersections. Hot spots, in addition to contributing large quantities of oil to stormwater runoff, also produce high oil concentrations in runoff. As with other pollutants, higher concentrations are easier to treat or reduce than lower concentrations. Therefore, we get the most economical reduction in oil and grease concentrations in County waters from treatment of urban hot spots.

Redevelopment and Oil Control

Current County requirements (see details below) do not differentiate between new development (no pre-existing structures on the site) and redevelopment (change of use or

modification of existing structures). A site only has to meet stormwater qulality treatment requirements if the project will create more than 5000 square feet of new impervious surface.

Redevelopment will need to be addressed in the revised manual both because of Ecology's requirement that stormwater controls apply specifically to redevelopment projects, and because of an emerging need to re-evaluate existing developments for significant water quality problems. Many developments currently in place were designed before awareness of stormwater quality problems, and even in some places quantity, problems. Systems were designed only for conveyance, with little or no retention or treatment. Many of these developed sites also are "hot spots" for production of oil and grease.

Ecology's approach to redevelopment is very aggressive, but it is also insensitive to the economic realities and site constraints that are inherent iun redevelopment projects. Ecology requires redevelopment sites of > 5000 sq. ft. to implement all core flow control and water quality requirements and, in some cases, to implement additional requirements. While an aggressive approach is attractive in that it would allow us to recapture previously uncontrolled development, it would also tend to encourage new development over redevelopment. No control, and thus no water quality benefits, would be realized if the requirements drive applicants to develop new sites instead of redeveloping existing property.

The goal for the County's redevelopment process is to apply space-efficient stormwater treatment BMPs to redevelopment projects to reduce pollutant loads at a reasonable cost. the primary objective of the redevelopment approach is to maximize water quality benefits while limiting the economic impacts, so that the overall costs of redevelopment are less than those for new development. A secondary objective was to keep the process simple and flexible, so it wouldn't be viewed as an additional burden to developers. In keeping with these objectives, it was decided to limit the scope of redevelopment to focus only on water quality improvements -- not on drainage improvements. There were several reasons for this limitation: 1) water quality impacts are often serious in commercial and industrial areas where redevelopment is likely, 2) typical redevelopment projects will not significantly change flows; 3) the basin planning process accounts for buildout conditions when setting quantity control requirements; and, 4) it is not economically feasible to try to solve serious water quantity problems through redevelopment restrictions.

Oil control BMPs are both generally space efficient, and, if used to treat hot spots, provide good treatment efficiency. The cost of these controls relative to the cost of re-development projects generally is low, and the facilities can, in many cases, be fitted into pre-existing stormwater conveyance systems. Oil control, therefore, will be used as the sole water quality requirement on re-development sites.

The definition of re-development is meant to include all major changes of use and reconstruction of developed sites. Sites that are updating building systems or resurfacing parking lots will be excluded. We want to catch sites that either are or will be subject to

high use and that will have the equipment and resources on hand to correctly install oil control devices. The following is the proposed definition of redevelopment sites:

Replacement of and/or alteration of the shell of existing commercial/industrial structures, not including alteration of electrical, plumbing, HVAC, or other interior building systems. Replacement of and/or alteration to impervious surface that is not part of routine maintenance, not including resurfacing, regrading or routine repair.

This definition is similar to that of the Department of Ecology (see Appendix ***). The County definition would specifically exclude renovation of interior building systems. It is assumed that this definition would encompass all site changes other than maintenance (parking lot striping, painting, sign replacement) valued at > $40,000 that would not create new impervious surface.

Under the proposed threshold, there would be no minimum size, only a minimum cost, for redevelopment projects. Thus this threshold would catch more projects than Ecology's threshold, which sets 5,000 sq. ft. as the minimum size for following the basic requirements. They would required only to install oil control devices,not to improve flow control or install other water quality treatment facilities. The rational behind this is that we would rather catch more small, highly polluting sites, than we would catch all large projects, regardless of their intensity of use.

Current County, State, and Local Requirements

King County

In the 1990 Design Manual, the following threshold for requirement of oil/water separation was included:

IF a proposed project will construct more than 5 acres of impervious surface in any threshold discharge surface in any threshold discharge area that will be subject to a) petroleum storage or transfer: OR b) high vehicular use (more than 2,500 vehicle trips per day), OR c) heavy equipment use, storage, or maintenance,

THEN a coalescing plate, or equivalent oil/water separator shall be employed (Special Requirement #6).

This requirement was designed to "catch" large sites that were likely to experience high traffic or petroleum use and storage. Larger sites it was assumed would have higher overall loading of oil and grease. This threshold was a good starting point but should be revised to reflect the influence of "urban hot spots" as described above. The size of the impervious surface does not determine the intensity of use. Park and ride lots, for example, generally produce very low concentrations of oil and grease although they are often quite large.

Washington State Department of Ecology

The following is the requirement for oil water separation contained in the 1992 *Stormwater Management Manual for The Puget Sound Basin*:

The requirement to use oil/water separators is dependent upon the specific land use proposed for development. Volume IV describes all of the major urban land use types (both public and private) that are likely to occur in either a proposed new development or in an existing development. While a number of activities may require the use of spill control (SC-type) separators, only a few will necessitate API or CPS-type separators. At a minimum, the following land use types have been identified as requiring API or CPS-type oil/water separators:

- industrial machinery and equipment, trucks and trailer aircraft, parts and aerospace, railroad equipment
- lot storage and sorting yards
- airfields and aircraft maintenance
- fleet vehicle yards
- railroads
- gas stations
- retail/wholesale vehicle and equipment dealers
- vehicle maintenance and repair
- construction businesses (paving, heavy equipment storage and maintenance, storage of petroleum products)

As an alternative to an API or CPS-type oil/water separator, a sand filtration BMP may be used to provide treatment of oil (Note: This alternative is being recommended on an interim basis and further evaluation is necessary). See Chapter III-3 for more information on sand filters.

The DOE requirement applies only to that portion of the impervious area that is subject to one of the uses above. Designers are urged to route additional flows around the oil/water separator. The DOE focus is on source control rather than on separation of oil from stormwater. Several of the urban hotspots for which the proposed County threshold will require treatment are mentioned in the DOE manual, but treatment methods are neither mentioned nor required. It seems almost as though the DOE requirement is more focused on spill control than it is on control of chronic, low-level pollution.

Proposed thresholds should not require collection of data in addition to that generated in the traffic portion of an environmental impact statement and/or permit process. In addition, treatment requirements should not place an excessive financial burden on small businesses.

Other Local Jurisdictions

The City of Bellevue requires that API or CPS separators are required in addition to spill control separators at:

- gas stations
- vehicle maintenance and repair facilities (inlcuding those at car dealers)
- heavy equipment storage and maintenance facilities
- outdoor storage areas for industrial machinery and equipment
- fleet vehicle yards
- high-turnover parking lots (assuming they drain to the storm drainage system) such as those at fast food restaurants, convenience markets, supermarkets, shopping centers, discount stores, hardware stores, and banks. (Typical office buildings, apartments, high quality restaurants, light industry, and schools do not have high-turnover parking lots.)

Ecology sizing criteria are used for the API or CPS separators (the 6-month 24-hour design storm). Bellevue is currently in the process of updating this regulation to require API or CPS separators only in high risk situations, but to require them to meet more stringent removal requirements (i.e. be larger in size).

The City of Seattle does not require oil-water separation in their surface water design manual. Oil-water separators are added to sites during the plan review process. This allows for negotiation of size and locations of facilities and by-passes the need for detailed requirements. because of the flexibility, and possibly because of the limited time available for plan review, few oil-water separators have been required to date.

Traffic and Oil-Grease Pollution

The focus of this section is on estimating oil and grease concentrations and loadings resulting from various levels of site use, especially of automobile traffic. Table 1 presents a summary of oil and grease data from several areas around Puget Sound. METRO performed a literature review of oil and grease data collected in the Seattle area and found that residential areas produce around 5 mg/l, high density and commercial produce 5 to 15 mg/l, and that freeways and other "concentrated traffic areas" produce up to 40 mg/l (METRO, 1990). An oil sheen can usually be observed on the water surface at or above a concentration of 2 mg/l.

A study of urban hotspots in the Washington D.C. area revealed that hydrocarbon concentrations in oil-water separators of several intensive land uses ranked in the following order, from highest to lowest: gas stations, all-day parking, convenience stores, streets, residential parking (Anon., 1994). Runoff from gas stations contained ten times the concentration of hydrocarbons as did residential parking. In the Seattle area, it appears that runoff from all-day parking (i.e. park and ride lots) contains little oil, while

runoff from the other land uses would be in the same order as those in Washington D.C. (Kennedy, personal communitcation, 1994).

Although there is extensive data on oil and grease concentrations from watersheds containing different land uses, little of this data is tied to levels of traffic usage beyond "low, medium, and high." In addition, there is almost no data in the area that specifically gives oil concentrations in runoff from high-use parking lots. The following section, therefore, will focus on estimating oil and grease concentrations in runof from high-use parking areas.

Table 1
Oil and Grease Concentrations in Runoff from Various Land Uses

Land Use	Oil and Grease Conc. (mg/l)	Comments	Reference
Watershed: open 9% residential 59% commercial 8% industrial 2% streets, hwys 22%	baseflow: 7.1 stormflow: 7.8	Residential area of Tacoma, WA	City of Tacoma, 1990
Watershed: open 10% residential 0 commercial 0 industrial 78% streets, hwys 12%	baseflow: 8.2 stormflow: 42.4	Industrial Waterfront area of Tacoma, WA	City of Tacoma, 1990
Watershed: open 2% residential 17% commercial 41% industrial 7% streets, hwys 33%	baseflow: 10.2 stormflow: 9.5	Downtown Tacoma	City of Tacoma, 1990
Bus Base	11.5-53	Bellevue, WA	Lettenmaier and Richey, 1985

Table 2 presents the expected average daily traffic and parking space turnovers for a number of types of high density developments. It is the number of turnovers per parking space per day that drives the concentration of oil grease in runoff because it is assumed that cars leak the most during idling and cool-down. Thus there would be lower oil and grease concentrations in runoff from a parking lot that experienced a low turnover rate than in one of the same size that experienced a high turnover rate.

Table 2
Expected Average Daily Traffic and Expected Parking Turnover for Several Land Uses

Land Use	ADT /1000 sf Floor Area	ADT - Weekday *	Average Size of Land Use*	Estimated Number of Parking Spaces**	Estimated turnovers per space per day***
Single-Family Residential	10/unit	10/unit	366 dwelling units	2	--
Specialty Retail	40.6	1126	27700	140	4
Hardware Store	51.3	1420	27700 sf	140	5
Low-Rise Apartment Bldg.	6.6/unit	1740	263 dwelling units	395	2.2
Convenience Store	887	1774	2,000 sf	10	89
Fast Food Restaurant (w/o drive-in)	777	2174	2800 sf	14	78
Grocery Store	125.5	2824	22,500 sf	113	13
Bus Park and Ride	4.2/space	3352	803 parking spaces	803	2
U.S. Post Office	86.6	3874	44,700	224	9
Office Park	11.4	4356	382,200 sf	1911	1.1

* Data are from ITE Trip Generation - 4th Edition (ITE, 1987). Numbers were obtained by multiplying the average trip rate by the average number of units.
NOTE: IF it is assumed that each vehicle enters, parks, and then leaves, the total number of vehicles parking on-site per day is ONE-HALF of the ADT.

** Based on number of parking spaces as required in King County Code Section 21.50.040)

*** The number of turnovers equals one-half the average daily traffic (see note above) divided by the estimated number of parking spaces.

Estimates of concentrations oil in runoff resulting from different levels of usage in parking lots are calculated based on the following assumptions:

* Cars leak the most when idling and during the cool-down period after being turned off. In other words, a car that sits in a parking space all day will contribute the same amount of oil and grease as does one that sits in a parking space for about an hour, or that sits and idles for a few minutes.

* The average car leaks approximately 1ml, 5 ml, or 10 ml per turnover

* That wash-off of oil and grease is about 50, 75, or 100 percent of the total deposited

* The storm producing washoff is 0.46" or 1.15 cm (Pitt and Bissonnette, 1984) (the mean annual storm)

* The average time between storms is 5 days (Pitt and Bissonnette, 1984)

* The oil and grease are washed off with the first 1/3 of the runoff volume

thus the equation used to calculate the concentration in runoff is:

$$\frac{[\text{amount leaked per day (ml = mg/day)}]\,[\text{days between rains}]\,[\text{washoff assumption (0,75)}]}{[\text{area of 1 parking space + 1 unit area of aisle (m}^2\text{)}]\,[\text{depth of avg. rain (m)}]\,[1/3]\,[1000\ \text{L/ m}^3]} = \frac{\text{Oil Buildup}}{\text{Stormwater Runoff}}$$

There will be some inaccuracy in oil is ligher than water so that milliliters don't exactly match milligrams, but this should be close enough for a first approximation. The "unit area" of aisle is equal to the width of one parking space times one-half the width of a two-way aisle.

Table 3
Turnovers per Day per Parking Space Producing 2 mg/l (Visible Sheen) Oil and Grease

Leakage (mg/l)	Washoff %	Turnovers per Day per Space Producing 2mg/l Oil (Visible Sheen)
1	50	80
	75	55
	100	40
5	50	8
	75	10

	100	15
10	50	4
	75	5
	100	8

Figures 1 a, b, and c present graphical estimates of oil and grease concentrations in runoff under the three washoff assumptions. The 2 mg/l concentration (visible sheen) is achieved at between about 4 and > 100 turnovers per day. It seems that cars leak in a somwhat digital fashion, in other words if they leak, they leak a lot, but if they don't leak, they don't leak. This makes estimation of exact concentrations in a given parking lot difficult. Using a low leakage from all cars probably accounts for this random pattern. If we assume, then, that average deposition of oil is about 2 ml per car, and that about 75% of this material washes off during an average rain storm, then the number of parking turnovers producing an oil sheen would be about 28 (say 25 for convenience). This number of turnovers is lower than the traffic level seen at fast food restaurants, convenience stores, and gas stations.

Proposed Threshold

Given the above data, there are several ways in which high-traffic thresholds could be formulated. Average daily traffic, turnovers per parking stall per day, or the total number of parking stalls could all be used to determine the high-traffic threshold. A combination of these types of thresholds will be used in order to capture the ease of use and advantages of each.

The following is the proposed threshold:

IF The proposed project has greater than or equal to 5000 ft2 of new total impervious surface, or is a redevelopment project (see definition below)

AND has an Average Daily Traffic (ADT) over 100 trips per 1000 sq. ft. of gross building area;

OR IF the site is subject to one of the following land uses:

- Petroleum Storage or Transfer (tanks > 10K gallons)
- Use, storage or maintenance of a fleet of greater than 25 diesel vehicles (trucks, busses, trains)
- Road intersections > 25,000 ADT for both roads

THEN: one of the "high use" menu options shall be installed and maintained as indicated.

EXEMPTION: Redevelopment Projects Valued at < $100,000

Redevelopment Definition:

Replacement of and/or alteration of the shell of existing commercial/industrial structures, not including alteration of electrical, plumbing, HVAC or other building systems. Replacement of and/or alteration to impervious surface that is not part of routine maintenance, not including resurfacing, regrading or routine repair.

High Use Menu

Catch-Basin Inserts with Absorbent Material
Linear & Vault Sand Filter
Leaf Compost Filter(???????????)
Vault with Oil Absorbant Material
Parking Lot Washing with Proper Disposal of Wash Water
Coalescing Plate Oil-Water Separator
API Oil-Water Separator

Average daily traffic is used already in the permit process. Developers have the option of either collecting data or using that contained in the Trip Generation Book (ITE, 1987). Daily traffic can easily be related to the number of parking spaces, and thus to the number of turnovers per day, using the following formula:

(ADT/1000sf *1000sf/5 parking spaces)/2 = TPD (turnovers per day)

The total is divided by 2 because it is assumed that two trips equals one car entering, parking, and then leaving. In general, the County zoning code requires one parking space per 200 square feet of gross floor area. Five parking spaces would be required for 1000 square feet of floor area. Thus the average daily traffic divided by 10 equals the approximate number of turnovers per parking space per day. Turnovers are a good indications of the intensity of use of a parking lot.

The inclusion of "leaky" operations such as vehicle fleet storage and maintenance is

In addition to the above requirement, developers should be encouraged to route oil-free runoff around the coalescing plate oil/water separator where one is required. This will prevent the dilution of concentrated oils in parking lot runoff.

Who's Captured

Sites that have a high intensity of use or that engage in activities that have been shown to have chronic problems with leaky vehicles will fall under the oil control threshold. The following business types would be required to install oil controls because of high traffic (as determined by Trip Generation (ITE, 1987):

Convenience Stores

Fast Food Stores
Gas Stations
Grocery Stores
Large Shopping Malls (non-overflow parking)
Discount Warehouse Stores
Banks

Sites that would meet the threshold for "leaky" operations in clude the following general types of sites:

bus fleet repair stations
truck fleet lots
auto and truck dealerships
truck repair
delivery services that use vehicles
manufacturing that stores fork lifts or other equipment outside
construction storage yards
airports
utility yards (water, electric, gas, etc.)

High Use Road Intersections:

Comparison to Other Local and State Oil-Control Requirements

The City of Bellevue uses a threshold of 50 ADT/1000sf for requirement of an oil-water separator. This appears to be a good level to which to treat runoff, but is too low to require the use of a coalescing plate separator. Coalescing plate separators generally are used when oil concentrations are expected to routinely exceed 10 mg/l. The County threshold would allow use of many different types of oil control devices, including oil-sorbent materials, which appear to be able to remove oil from runoff even at very low concentrations.

This threshold would be somewhat stricter than that in the DOE Manual. The DOE currently requires coalescing plate systems for certain land uses which are consistent with our spill control oil separation requirement. There is no treatment, only source control practices, required for land uses other than those specifically called out in the manual.

The King County and DOE requirements for spill control structures will be the same The requirement for oil spill control based on land use is straight from the DOE manual (page 1-4-7). This requirement is equivalent to the one in the current King County manual, except that the threshold area of impervious surface has been eliminated. Similar to the argument for small high-use parking lots, small areas of impervious surface are often used to store significant amounts of fuel and other oils. If spilled into the storm drainage system, these materials would have a significant effect on the environment. In

the current and future manuals, spill control is included as part of the conveyance requirements.

Costs: Treatment Alternatives

The costs of changing the threshold for requirement of oil separation include the initial cost of treatment structures, and continued maintenance costs over the lifespan of the project. Coalescing plate oil/water separators cost approximately $15,000 installed. Other types of systems are far less expensive. Low-tech systems such as catch-basin inserts may cost about $200 per catch-basin to install. Maintenance needs will vary depending on the type of system selected. Catch-basin inserts may need to be cleaned and the absorbent replaced every 3-4 months. Coalescing-plate oil/water separators may need to be pumped frequently depending on the amount of incoming oil. Costs and maintenance requirements of these systems are being covered in a separate oil/water separator design issue paper.

Treatment technologies for oil/water separation fall into two basic categories: Those that work by physical separation, and those that work by coating of or chemical reaction with absorbent materials. A number of source control technologies also can be employed to prevent oil contamination of stormwater runoff. The following is a brief overview of these technologies and a recommendation as to whether they should be included in the Design Manual.

The physical Oil/water separator (OWS) category includes coalescing plate (CPS), baffle type (API), and spill control type (turned down elbows). Metro has conducted a review of these facility-types (Romano, 1990). It was found that turned-down elbows provide spill control but that oil flushes through them if they are not pumped regularly. The API baffle-type separator was perceived to be more effective than down-turned elbows because it is designed to minimize turbulence and to maximize settling. Again, however, the API separator provides no removal if the collected oil is not pumped out regularly. In a recent City of Seattle effort, blocks of oil-absorbent materials and floating booms have been added to API separators. Although there is yet no data on the effectiveness of this type of system, observations suggest that it will significantly outperform a plain API device. Oil is less likely to flush through this type of system because it is held in the absorbent materials.

The Coalescing plate OWS (CPS) improves oil/water separation by increasing the path-length of through-flowing water. Designs and specifications for these devices are reviewed in a separate issue paper. In general, these systems have been able to reduce effluent oil concentrations to about 10 mg/l (Owens Corning, Purification International). A system at a Bellevue bus base produced a median concentration of 4.5-21 mg/l with inflow concentrations of between 11.5 and 53 mg/l (Lettenmaier and Richey, 1985). The CPS is compact and relatively easy to install. The CPS is somewhat costly, but this cost is offset by ease of maintenance as compared to other types of separators. In addition, CPS separators also can be designed to provide emergency spill control, and so may eliminate

the need for a downturned elbow or other spill control device at the system outlet.CPS facilities are are best used in settings where it is expected that oil concentrations in runoff will routinely exceed 10 mg/l.

A variety of absorbent materials are used to effectively contain and remove spills of oil and other petroleum products in emergency spill situations. Several of these materials may also be effective for removal of lower levels of oil from stormwater. The absorbents can either be placed in catch-basin inserts, or they can be used as floating booms or pillows. The materials most commonly used as absorbents include oilophyllic synthetics, peat moss, and wood by-products. Table 4 presents the treatment capabilities of several of these materials (please note that many of these numbers are from the manufacturers and therefore may be somewhat optimistic). Upcoming results from the City of Seattle's use of oil absorbent materials in an API separator may provide more information on the performance of various oil absorbent materials. It appears that the removal capabilities of many of these materials are quite good.

Parking lot washing may be a viable option for treatment of oil and grease. This would eliminate the discharge of oil and grease to the storm drainage system. METRO uses a mobile washer in the downtown Seattle bus tunnel. The transit section is interested in experimenting with use of this washer in parking lots. It probably also would be fairly easy to educate and/or equip those that currently pressure wash trucks to pressure wash parking lots, making sure that the process water is collected and treated (most truck washers either pump wastewater to the sanitary sewer or into a holding tank on a truck for later disposal). Many businesses such as MacDonald's already wash their parking lots and dispose of the wastewater in the storm drainage system. Recommendation of alternate practices on new parking lots would help in our education efforts with owners of old parking lots.

All of the above absorbent materials and source control options should be included in the final update of the Design Manual. Most of these materials appear to provide good treatment. Proposed systems should be reviewed by SWM and perhaps minimal monitoring could conducted during the first few years of operation. Absorbent materials, because they work by coating of the absorbent material and/or chemical attraction, are an good option because collected oil would be much less likely to wash through during storm events than with coalescing plate or API separators. Laboratory experiments suggest that these materials can effectively trap and hold oil (Brake, 1994). Although information on these materials is incomplete, it seems worth it to install and monitor them. Source control is the direction in which water quality treatment regulation is moving (our own BMP manual is an example of this). To suggest parking lot washing would be consistent with source control efforts.

Table 4
Effectiveness of Several Oil-Absorbent Materials

Material	Influent/Effluent Concentration (mg/l)	Structure Holding Absorbent Material	Source and Comments
Absorbent W ?????	30/2.2	catch-basin insert	Industrial Site "A" lab test at 2-3 gpm (EMCON NW)
Absorbent W?????	56/<1	catch-basin insert	Industrial Site "B" lab test at 2-3 gpm (EMCON NW)
Compost	3.5/0.78, 4.2/0.66, 8.2/0.72	W & H Pacific Compost Stormwater Filter	Field Data (W&H Pacific, 1993)
Peat Moss	715/25.5, 146/10.3, 164/108	laboratory column	crude oil at 3 low flow rates (12 to 100 ml/min) (Viraraghavan and Mathavan, 1990)
Oilophyllic Polyester			
Wood By-Products			

Benefits of the Oil Control Requirement

This requirement will benefit other on-site water quality facilities and downstream aquatic ecosystems. Oil control would reduce both acute and chronic loadings of oil to waterways. Acute loading will be reducedas spill control devices are not relied upon to provide continual low-level oil control. Spill control structures often are not monitored or cleaned on a regular basis. As a result, collected oil often washes through during storms, causing spikes in oil concentration in receiving waters. Chronic loadings will be reduced as oil concentrations from individual sites are lowered. As shown in the example 1 in Appendix A, loading from a typical convenience store would be reduced by about 50%. Reductions in oil concentrations from larger sites would be somewhat less (because of dilution), but would still be around 30% as shown in example 2 in Appendix A. In most cases, concentrations would be reduced below the level where there would be a visible sheen on the water.

Oil pollution reduces beneficial uses of our waterways. Oil sheens are smelly and unsightly. They prevent recreational swimming fishing and, in extreme cases, boating. Although sheens from direct runoff of oil occur mostly in the winter when few people are on the water, buildup of oil in sediments also can lead to sheens in the summer if sediments are stirred up. The proposed high use threshold would greatly reduce the number of direct runoff sheens produced in our waterways. In addition, buildup of oil in sediments would be slowed, and so the incidence of sheens caused by stirring of sediments would fall dramatically.

Oil control will slow the buildup of oil in the sediments of lakes and streams. An oil loading of about 1-2 liters per site per average storm (i.e. per 5 days) for high use sites would contribute about 73 liters per site per year. Depending on the number and size of new or re-developing high use sites (there were 35 sites that would meet high use criteria in the last two years of DDES permits), this would add up to about 1000 litres (264gallons) of oil that would be kept out of County waterways. This is in addition to any extra oil that could be captured by these devices during spill situations (downturned elbows and other spill control devices are designed only to catch the majority of a large spill. Oil control structures could probably catch significant quantities of the oil that would not be captured by spill control). The number of sites re-developing in the County is expected to increase over the next few years as urban in-filling is encouraged. This would further decrease loadings to County waterways.

Reduced oil and grease in runoff will enhance the functional capability of downstream water quality facilities. Oil can coat vegetation in water quality facilities, stunting and/or killing it. This hinders uptake of metals and nutrients, as well as diminishing sediment trapping capability. If oil collects in the sediments of water quality facilities, any dredge material from the facility may have to be disposed of as contaminated soil, which is much more expensive than regular disposal.

Aquatic ecosystems will benefit from decreased loadings and concentrations of oil and grease. In the commentary for its oil and grease guideline it was noted that concentrations as low as 10-100 ug/l in water cause disruption of physiological processes such as feeding and reproduction in a variety of aquatic organisms (EPA, 1986). In addition, reduction of the oil loading will slow the accumulation of oil in sediment, which has been linked to mortality and toxicity in benthic organisms. Prevention of oil buildup in sediments also would help to prevent the costly cleanup of freshwater and/or marine sediments such as that which will be required in Eliot Bay at the mouth of the Duwamish River or in portions of Commencement Bay in Tacoma. This has an obvious cost which in the Puget Sound Region has been estimated at millions of dollars (PSWQA, 1993).

FRESHWATER MUSSELS - FISH

The oil control requirement would be phased in gradually. In the last two years of permit files at DDES, 35 out of approximately 3000 permits would meet high use requirements. As re-development takes place in dense, urban areas, more sites would have to provide oil control. Thus there would not be a huge number of people implementing the requirement at one time. We could monitor a few select sites and see whether the oil control techniques that we have recommended are working. Oil control methods could then be monitored accordingly. The gradual implementation of the requirement also would dovetail with our source control efforts. Oil-water separation can be seen as an interim measure to be used until source control efforts are able to make it unnecessary.

Conclusion

Oil and grease are persistent and pernicious pollutants in the urban environment. Current County design requirements do not fully address oil and grease pollution. High concentrations of oil and grease can come from high turnover parking lots and from petroleum storage, heavy equipment use, etc. on small as well as large areas of impervious surface. The proposed threshold identifies areas which are likely to produce concentrations of oil and grease that are treatable either with physical oil/water separators and spill control devices, or with absorbent materials or source control practices. Although the requirement may raise development costs on some parcels, it may lower maintenance and vactor waste disposal costs. The aquatic environment will benefit from lower oil and grease loadings and the County will be protected from liability in regards to costly cleanups of oil-contaminated sediments.

Prepared By: Jenny Gaus
Water Quality Engineer
King County Surface Water Management

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